is contemplated for compliance monitoring purposes, or where monitoring frequency is only quarterly. In this case, both the average monthly and the MDL would exceed the criterion. (For example, for a CCC of 1.0 chronic toxic unit [TU_c] applied as a WLA at the end of the pipe, both the MDL and AML would be 1.6 TU_c; assuming CV=0.6, n=1, and a 99-percent probability basis.) A discharger could thus comply with the permit limit but routinely exceed the criterion. **Under these circumstances, the statistical procedure should be employed using an assumed number of samples of at least four for the AML derivation.**

5.5.4 Probability Basis

Selection of the probability basis for use in the equations in Boxes 5-1 and 5-2 is a permitting authority decision necessary for establishing statistically derived permit limits. **Where a permitting authority does not have specific guidance for the probability basis, EPA recommends the following:**

For calculation of the LTAs from the WLAs (Box 5-2):

- Both acute and chronic WLA—.01 probability (99th percentile level).

For calculation of permit limits from the most limiting LTA (Box 5-1):

- MDL—.01 probability basis (99th percentile level)
- AML—.05 probability basis (95th percentile level).

The probability levels for deriving permit limits have been used historically in connection with development of the effluent limits guidelines and have been upheld in legal challenges to the guidelines [4]. It is important to note that these levels are statistical probabilities used as the basis for developing limits. The goal in establishing these levels is to allow the regulatory agency to distinguish between adequately operated wastewater treatment plants with normal variability from poorly operated treatment plants and to protect water quality criteria.

The level for the calculation of the LTA from the WLA is based upon EPA's interpretation of the steady state model used to develop the WLA. EPA considers the WLA to produce an effluent condition that should never be exceeded whenever the critical design conditions occur. To characterize this effluent condition, EPA uses the 99th percentile concentration from the upper tail of the effluent probabilistic distribution curve. The selection of this value is one which can have a significant influence on the level of conservatism in the permit limits. Permit authorities should consider Figures 5-8 and 5-9 to understand the effect of this decision along with other decisions on the AMLs and MDLs.

5.6 PERMIT DOCUMENTATION

The fact sheet and supporting documentation accompanying the permit must clearly explain the basis and the rationale for the permit limits. When the permit is in the draft stage, the supporting documentation will serve to explain the rationale and assumptions used in deriving the limits to the permittee and the general public in order to allow public comment on the draft permit. When the permit is issued, the administrative record for the facility (particularly the fact sheet) will be the primary support for defending the permit in administrative appeals including evidentiary hearings. This information also will serve to alert compliance/enforcement personnel to any special considerations that were addressed at the time of permit issuance. In addition, the accompanying documentation will be extremely important during permit reissuance and will assist the permit writer in developing a revised permit.

In 40 *CFR* Part 124.56, a fact sheet containing "[a]ny calculations or other necessary explanation of the derivation of specific effluent limitations" for many draft permits is required. Accordingly, the WLAs along with the required LTA and CV used and the calculations deriving them must be included or referenced in the fact sheet. The permit limit derivation method used must also be explained in the permit documentation. Where a permitting authority develops a standardized and simplified method for permit limit development as discussed in Section 5.4.2, the permitting authority may not need to document all of the underlying assumptions in the fact sheet, provided that the fact sheet references a written permit limit development protocol. Any other guidance used must also be cited.

5.7 EXPRESSING LIMITS AND DEVELOPING MONITORING REQUIREMENTS

Limits must be expressed clearly in the NPDES permit so that they clearly are enforceable and unambiguous. Chapter 6 discusses compliance monitoring and enforcement problems that can result from improperly expressed limits. All limits, both chemical-specific and whole effluent, should appear in Part 1 of the permit. Special considerations in the use of both chemical-specific and whole effluent toxicity limits are discussed below.

5.7.1 Mass-based Effluent Limits

Mass-based effluent limits are required by NPDES regulations at 40 *CFR* 122.45(f). The regulation requires that all pollutants limited in NPDES permits have limits, standards, or prohibitions expressed in terms of mass with three exceptions, including one for pollutants that cannot be expressed appropriately by mass. Examples of such pollutants are pH, temperature, radiation, and whole effluent toxicity. Mass limitations in terms of pounds per day or kilograms per day can be calculated for all chemical-specific toxics such as chlorine or chromium. Mass-based limits should be calculated using concentration limits at critical flows. For example, a permit limit of 10 mg/l of cadmium discharged at an average rate of 1 million gallons per day also would contain a limit of 38 kilograms/day of cadmium.

Mass-based limits are particularly important for control of bioconcentratable pollutants. Concentration-based limits will not adequately control discharges of these pollutants if the effluent concentrations are below detection levels. For these pollutants, controlling mass loadings to the receiving water is critical for preventing adverse environmental impacts.

However, mass-based effluent limits alone may not assure attainment of water quality standards in waters with low dilution. In

these waters, the quantity of effluent discharged has a strong effect on the instream dilution and therefore upon the RWC. At the extreme case of a stream that is 100 percent effluent, it is the effluent concentration rather than the effluent mass discharge that dictates the instream concentration. Therefore, **EPA recommends that permit limits on both mass and concentration be specified for effluents discharging into waters with less than 100 fold dilution to ensure attainment of water quality standards.**

5.7.2 Energy Conservation

Water quality-based permit limits by themselves do not provide any incentive to dischargers to reduce wastewater flows. The reverse is true; a more dilute effluent means water quality-based limits are more easily achieved. However, increased flow translates into increased power consumption for treatment facilities. Significant power usage stems from pumping and mixing of volumes of wastewater in treatment systems. If the volume of wastewater can be reduced, power consumption can be reduced and less fossil fuel burned. Such reductions can be expected to result in concomitant decreases in air pollution.

Therefore, EPA recommends that flow reductions and energy savings be specifically encouraged where appropriate (usually in dilutions greater than 100:1) by allowing water quality-based permit limits to be mass-based and by allowing concentration-based limits to vary in accordance with flow reduction requirements. The permit also could include an energy savings analysis subject to approval by the permitting authority.

5.7.3 Considerations in the Use of Chemical-specific Limits

Metals

Another common problem encountered in expressing permit limits occurs for metals. Some water quality standards express numeric criteria for metals in terms of the dissolved or acid soluble phase of the metal. NPDES regulations at 40 *CFR* 122.45(c) require permit limitations for metals to be expressed in terms of total recoverable metal unless (1) an effluent guideline requires the use of another form, (2) technology-based limits are established on a case-by-case basis, or (3) the approved analytical method measures only the dissolved form.

Where State water quality standards are expressed directly as total or total recoverable metals, the permit limit can be established directly. Where the water quality standards are expressed as dissolved or acid soluble metal, the permit writer will need to reconcile the different expressions of metals when establishing the permit limits. Some State water quality standards implementation policies or procedures provide the requirements for this conversion. In instances where a State has no policy or procedure, the permit writer can take one of four approaches. First, the permit writer could assume no difference between the dissolved or acid soluble phases and the total recoverable phase. This is the most stringent approach and would be most appropriate in waters with low solids, where the discharged form of the metal was mostly in the dissolved phase, or where data to use the other options are unavailable. Second, the permit writer could develop a site-specific relationship between the phases of metals by developing a relationship through review of information on instream metal concentrations. This approach requires concurrent sampling of both metal phases during periods reflective of the environmental conditions used to determine the WLA. Third, the permit writer could use a relationship developed by EPA from national data; this relationship is described in the national guidance for determining WLAs for toxic metals in rivers. This relationship requires knowledge of instream concentrations of total suspended solids at the environmental conditions used to determine the WLA. Fourth, the permit writer could use a geochemical model, such as the equilibrium metal speciation model MINTEQA2 (see Chapter 4). However, the input data requirement of this model are equivalent to collecting site-specific data under Option 2. These options will be expressed in more detail in subsequent guidance issued by EPA.

Update: The Agency has issued "Interim Guidance on Interpretation and Implementation Aquatic Life Criteria for Metals." See the update notice in front of this document for availability.

Detection Level Limits

A commonly encountered problem is the expression of calculated limits for specific chemicals where the concentration of the limit is below the analytical detection level for the pollutant of concern. This is particularly true for pollutants that are toxic in extremely low concentrations or that bioaccumulate.

The recommended approach for these situations is to include in Part 1 of the permit the appropriate permit limit derived from the water quality model and the WLA for the parameter of concern, regardless of the proximity of the limit to the analytical detection level. The limit also should contain an accompanying requirement indicating the specific analytical method that should be used for purposes of compliance monitoring. The requirement should indicate that any sample is analyzed in accordance with the specified method and found to be below the compliance level will be deemed to be in compliance with the permit limit unless other monitoring information (as discussed below) indicates a violation. Sample results reported at or above the compliance level should be reported as observed whereas samples below the compliance level should be reported as less than this level.

The level of compliance cited in the permit must be clearly defined and quantified. **For most NPDES permitting situations, EPA recommends that the compliance level be defined in the permit as the minimum level (ML). The ML is the level at which the entire analytical system gives recognizable mass spectra and acceptable calibration points.** This level corresponds to the lowest point at which the calibration curve is determined based on analyses for the pollutant of concern in a reagent water. The ML has been applied in determinations of pollutant measurements by gas chromatography combined with mass spectrometry. The concept of a minimum level recently was used in developing the Organic Chemicals, Plastics, and Synthetic Fibers effluent guidelines [5].

The minimum level is not equivalent to the method detection level, which is defined in 40 *CFR* Part 136 Appendix B as the minimum concentration of a substance that can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte. EPA is not recommending use of the method detection level because quantitation at the method detection level is not as precise as at